NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

Under the naval appropriation act (Public No. 271, Sixty-third Congress) approved March 3, 1915, the Congress provided for a National Advisory Committee for Aeronautics consisting of not more than 12 members, to be appointed by the President. The act prescribes the membership as follows: 2 from the War Department (office in charge of military aeronautics), 2 from the Navy Department (office in charge of naval aeronautics), 1 each from the Smithsonian Institution, the United States Weather Bureau, and the United States Bureau of Standards, 5 additional persons acquainted with the needs or skilled in aeronautical science and its engineering side.

The duty of the committee is to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions. The committee may direct and conduct research and experiment in aeronautics in such laboratories as may happen to be placed under its direction, under rules and regulations for the conduct of the work formulated by the committee and approved by the President. This committee serves without extra compensation and has the sum of $5,000 for five years to devote to experimental work and investigations, clerical expenses and supplies, and necessary expenses of the committee in traveling to and from and while attending the meetings of the committee.

Under the authority granted by Congress President Woodrow Wilson appointed the following gentlemen as members of the committee.

Membership of the Committee.

Brig. Gen. GEORGE P. SCRIVEN, U. S. A., *Chairman*, Chief Signal Officer, War Department.
Naval Constructor HOLDEN C. RICHARDSON, U. S. N., *Secretary*, Navy Department.
Prof. JOSEPH SWEETMAN AMES, Ph. D., Johns Hopkins University, Baltimore, Md.
Capt. MARK L. BRISTOL, U. S. N., Director of Naval Aeronautics, Navy Department.
Prof. WILLIAM F. DURAND, Ph. D., Stanford University, California.
Prof. JOHN F. HAYFORD, C. E., Northwestern University, Evanston, Ill.
Prof. CHARLES F. MARVIN, M. E., U. S. Weather Bureau, Washington, D. C.
Hon. BYRON R. NEWTON, Treasury Department, Washington, D. C.
Prof. MICHAEL IDVORSKY PUPIN, Ph. D., Columbia University, New York, N. Y.
Lieut. Col. SAMUEL REBER, Signal Office, War Department, Washington, D. C.
SAMUEL W. STRATTON, Sc. D., U. S. Bureau of Standards, Washington, D. C.
CHARLES D. WALCOTT, Sc. D., Smithsonian Institution, Washington, D. C.

This committee duly met, drew up rules and regulations for the conduct of the work of the national committee, and organized an executive committee. The President of the United States approved the rules and regulations on June 14, 1915.

WORK DURING 1915.

The following memorandum, covering in a general way the work accomplished by the committee during the past year, was issued by the secretary on October 30, 1915, at the suggestion of the executive committee:

1. The executive committee, acting on authority delegated to it by the advisory committee, entered into contract with the Massachusetts Institute of Technology for a report on the subject of aeroplane stability, which report was submitted by Naval Constructor Hunsaker and Professor Wilson, the substance of the report being a mathematical treatise of the subject and an experimental determination of the characteristics of a normal type aeroplane. On this data and on the basis of an ingenious method of manipulation of Routh's Discriminata, causes and valuable conclusions have been arrived at relative to the behavior of an aeroplane under two different conditions, the first being that of an aeroplane whose controls remain fixed while entering a puff; the second being that of an aeroplane whose controls are manipulated, either by the pilot or by automatic means, in such a manner that it retains a fixed attitude while encountering the puff. The conclusions show that where an aeroplane follows its natural path in encountering a puff, it is elevated to a mean height of about three times that of the acceleration of the puff in feet per second, and then follows an oscillating path, returning to a neutral condition at the elevation given; whereas, the aeroplane controlled so as to maintain its attitude of flight, is raised to a mean height equal to that of the acceleration. The effects of a following gust are of the opposite nature. It appears that the accelerations acting on the machine are such as to bring into play stresses which are well inside of those provided in a factor of safety of 7 or 8. However, it appears that though the machine retaining a fixed attitude, rises and falls less when encountering a puff than the other machine, it has less range of safe flying speed.

2. A contract was also entered into with Columbia University for a report on means of improving the design of aeronautic engines, and this has resulted in a voluminous and valuable treatise being submitted by Professor Charles E. Lucke, of Columbia University. The treatise is divided into three parts and contains, besides Professor Lucke's main report of his investigations and conclusions, a large amount of valuable information collected from all sources, showing the status of aeronautic engine design at this time. Based on the conditions found, Professor Lucke offers valuable suggestions toward the improvement of reliability, adaptability, and efficiency, with due regard to the weight of the complete power plant.

3. Another contract was entered into with the United States Rubber Co., at a nominal sum, for an investigation and report relative to the merits of different qualities of aeronautic fabrics, which includes a report on friction based on tests conducted in the wind tunnel at the Washington Navy Yard. The report shows, so far as friction is concerned, that the friction of all fabrics is reduced to a very satisfactory degree by the use of any good grade of spar varnish, and that surfaces in their natural finish have much greater coefficients of friction. The relative merits of different fabrics as to tensile strength, weight, hygroscopic qualities, fire-resisting qualities, permeability, etc., are discussed in a satisfactory manner. It appears that it is very probable that practically any grade of aeronautic fabric can be made fireproof to a satisfactory degree, though the means used in the experiments were not entirely satisfactory, on account of the deterioration which took place when the necessary compounds were introduced to a sufficient degree to completely destroy the inflammable qualities of the fabric.

4. An effort was made to obtain a report from Cornell University relative to the design of a muffler for aeroplane engines, but by reason of delays in completing the

contract, and unfortunate explosions wrecking the first two devices constructed, this work has been delayed. However, it is probable that further tests may present more satisfactory results.

5. A valuable report was contributed voluntarily by John A. Roebling's Sons Co., on the subject of wire terminals for aeroplane construction. Their report, while not complete, is in very satisfactory form, and shows that it is possible to obtain 100 per cent efficiency of terminal construction with hard wire, strand, and cable. The point is raised that the efficiencies of the different types of wire trussing, based on weight for strength, are in the order of wire, strand, and cable, and it is therefore not clear why there appears to be a general preference in this country and abroad for the use of strand and cable, and it appears that other factors than those considered in the investigation must be of importance, the probable factor being that of elasticity, though no definite reasons for such preference were presented.

6. The Advisory Committee instituted an investigation as to the facilities available in different colleges, technical institutions, engineering institutions, and among manufacturers and various aeronautic societies, for the carrying out of aeronautic investigations. It found that limited facilities were available for attacking various problems of aeronautic design, and that they could be made available to the committee, provided sufficient funds were available to carry out the necessary experiments, or to engage competent engineers on different phases of the work. A large number of colleges have available mechanical laboratories and engineering courses capable of application to aeronautics, but only the Massachusetts Institute of Technology and the University of Michigan so far offer regular courses. Worcester Polytechnic Institute has conducted experiments on full-sized propellers mounted on a whirling table turning on a pivot in the middle of a pond. The arms of the whirling table are provided at one end with a dynamometer for measuring the torque and thrust and revolutions of the propeller, and at the center a control stand for controlling the speed of the propeller. The speed of the rotating arm is controlled by means of a drag in the water, attached to the opposite end of the rotating arm. While there are objections to this method of testing in a circular path in the open, the method is ingenious and the results obtained should be valuable, particularly for comparison. In general, however, it appears that the interest of colleges is more one of curiosity than that of considering the problem as a true engineering one, requiring development of engineering resources, and, therefore, not yet of sufficient importance to engage their attention, except in a fundamental way. Manufacturers, naturally, are principally interested in the development of types which will meet Government requirements, or popular demand, but which will not involve too radical or sudden change from standard types.

7. It was found that the Bureau of Standards is well equipped for carrying on all investigations involving the determination of the physical factors entering into aeronautic design, and is prepared to take up such matters as are of sufficient general interest to warrant same. The bureau had already prepared, but not published, a paper on the subject of Pitot tubes with reference to their use for air speed meters. This paper was prepared by Professor Herschel and Dr. Buckingham. It was submitted to the executive committee in rough form, and the Bureau of Standards is now placing it in form for publication by the committee. It gives an interesting description of the investigation of the properties of different types of air speed indicators.

8. The Navy Department is equipped with a model basin and wind tunnel at the Washington Navy Yard, with adequate shop facilities for carrying on the work in a limited way, and is also constructing at the Washington Navy Yard a plant for the testing of aeronautic motors and devices involved in their operation, which will be in commission at an early date. Also, under the Navy Department steady progress is being made in attacking practical problems involved in the development of the Navy aeronautic service at its station at Pensacola, and theoretical and practical design are in hand in the Bureaus of Construction and Repair and Steam Engineering.

9. The War Department has limited facilities at the flying school at San Diego, for investigations of interest to that branch of the service, and is able to carry out in a limited way experiments of interest to the service on full sized machines, for which work it has the assistance of technical experts.

10. The Weather Bureau is well equipped for the determination of the problems of the atmosphere in relation to aeronautics, and Professor Marvin, a member of the Advisory Committee, is the chairman of a subcommittee engaged on this problem. The work, however, is limited until the necessary funds for more extensive work become available. There is already available in the records of the bureau much information of value which requires compilation in a form suited to aeronautic requirements, and this work will be the subject of a preliminary report to be included in the annual report of the committee.

11. The Smithsonian Institution has been engaged for a number of years on the compilation of the bibliography of aeronautics, and is prepared to continue this work for at least two years more with the funds at its disposal. The Institution has also contributed funds toward the development of the work of the subcommittee of the Weather Bureau in its investigation of the problem of the atmosphere in relation to aeronautics.

SPECTRUM AND TEMPERATURE OF THE SOLAR PHOTOSPHERE.[1]

By A. AMERIO.

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This lengthy and exhaustive monograph gives a detailed account of the author's researches in this domain. The object of the investigation is set forth and the spectrobolometric arrangement employed is illustrated. It is impossible in a short abstract to cover the whole ground, but a few of the more important results may be referred to. The observations were made in 1908–1911 at 4 stations, namely Rome, Alagna, Col d'Olen, and Capanna Regina Margherita, the atmospheric absorption being calculated by imagining the atmosphere to be divided into 4 strata and assigning separate coefficients to each station, according to its elevation. From the total observations it is deduced that the radiation reaching the earth at the upper limit of the atmosphere, from the center of the solar disk is 2.51 gm. cals. per sq. cm. per min. From this and from the data as to the energy distribution on the solar disk the solar constant 2.09 can be deduced. But the solar atmosphere has the effect of reducing the energy radiated by the photosphere in the ratio 150:100; so that the value of the solar constant if

[1] Mem., Accad. Lincei, 1914, 9, No. 9, p. 323-383.